

REMARKS

I. Introduction

Applicant appreciates the thorough examination of the application that was manifested in the Office action of 16 January 2004 (Paper 3). Claims 1-26 are currently pending in the present application. In view of the foregoing arguments, applicant respectfully submits that the Office action be reconsidered.

II. Current status of the claims

The undersigned respectfully calls Examiner's attention to the fact, not specifically mentioned previously, that intra-claim links CHARACTERIZED BY in the PCT application had been changed, upon preparing the present application to filing with the USPTO, for WHEREIN or FURTHER COMPRISING in all 26 claims. For the reason of this change, all the above claims are shown as previously presented.

III. Specification

The disclosure was objected to because numeral 46, which page 14, line 20 was referring to with regard to Figure 6, was missing from Figure 6.

Numeral 46 has been added in red in Figure 6, which, along with corrected Figures 1-5, is being submitted herewith for Examiner's approval.

With that in view, it is believed that the objection is overcome, and applicant respectfully submits that it be withdrawn.

IV. Drawings

Figures 1-5 of the drawings were objected to under 37 CFR 1.84(o) in the sense that a word label or description for the boxes was requested "so that a reading of the specification is not necessary for an understanding of the drawings."

Description for the boxes has been added in red in Figures 1-5, which, along with corrected Figure 6, are being submitted herewith for Examiner's approval.

V. Claim rejections under 35 USC § 102

V.1. Claims 1-3, 5-8, 10, 11, 17, 19, 20-22 was rejected under 35 U.S.C. § 102(b) as being anticipated by Matama (U.S. Patent 5,739,922 A).

V.2. Applicant respectfully disagrees. It is worthwhile to note that Matama deals with the image processing of color image signals obtained by reading out a color image (Matama, column 1, line 11), and - since he uses the correlation between color components (Matama, column 16, line 35, formula (3)) - his method, unlike the applicant's invention, does not seem to be applicable to non-color images (for example, gray scale images like black and white photographs).

Applicant's invention, as claimed in Claim 1, constitutes a totality of the following mutually related steps:

providing an original image as a matrix of discrete picture elements (pixels),

splitting said original image into n frequency channels, each of said n channels being presented by an image matrix of the same size as said original image, said splitting said original image is performed into a low frequency channel and n-1 high frequency channels,

detecting edges, said detecting being performed by calculating in each of said n-1 high frequency channels for each pixel a correlation value between a processed pixel and its neighboring pixels followed by comparing said correlation value with correlation values for the corresponding (by their location in the image) pixels in other said high frequency channels and with a first threshold value for this channel, and forming weighting coefficients based on the results of said comparing for each pixel of each of n-1 high frequency channels, and

assembling an output image from said n frequency channels taking said detected edges into account, said assembling being made by summing each pixel from said low frequency channel with all the corresponding (by their location in the image) pixels of said n-1 high frequency channels multiplied by their weighting coefficients.

V.3. A careful review of the Matama patent failed to uncover detecting edges in the patent. The method disclosed by Matama does not appear to provide for the edge detection. It shows from the patent that Matama uses the term “edge portion” to denote areas with sufficiently high values of the High Frequency components. At column 2, line 47, Matama mentions “a texture portion of the image, and an edge portion of the image.” At column 3, line 23, Matama mentions again “the local area limited variance values of the texture portion, the edge portion, or the like.” These examples show that Matama uses “edge portion” as a designation of some image area rather than the reference to some particular edges. Matama states (column 17, line 5 of the patent) that “where the correlation value is larger than the predetermined threshold value, the portion associated with the correlation value can be regarded as being the edge portion of the image.” It means technically that some structures are present in this portion of the image. However, this area may contain no edges at all if it is formed for example by many dots. Therefore Matama’s designation of this “portion” as “edge portion” is not what is used for the present application, and this seems to be true for the whole Matama patent.

Considered formally, Matama does not disclose the edge detection operations as claimed in claim 1 of the present invention. First of all, it should be pointed out that there is a principal difference between the claimed method and the Matama’s invention that lies in the use of different correlation values. Whereas Matama uses the correlation between color components of the same pixel (column 4, line 56; column 4, line 65; column 16, line 35 (formula (3)); claim 9 (column 23, line 11), etc. of Matama), the applicant’s invention, on the other hand, makes use of, and claims, a method based on “the correlation between processed pixel and its neighboring pixels” (claim 1; page 6, lines 14-24; page 8, lines 25-26; page 9, lines 19, 24; page 15, line 22-page 16, line 11, etc. of the applicant’s specification and claims). Also,

- with regard to calculating a correlation value in each of high frequency channels between a processed pixel and its neighboring pixels claimed in claim 1: Matama does not seem to teach this operation, and column 19, line 16, of Matama cited in the Office action (paragraph c1 of section 5 of the Office action) does not show this operation either; the text cited in the Office action from Matama (column 19, lines 13-20: “In cases where

the correlation value ϵ among the colors is smaller than a predetermined threshold value, the degree of emphasis of the high frequency component corresponding to the picture element, which is associated with the correlation value smaller than the predetermined threshold value, may be set to be lower than the degree of emphasis of the high frequency components corresponding to the other picture elements.”) describes a method to define “the degree of emphasis” (weighting coefficient). It is irrelevant to calculating correlation disclosed in the present application. Therefore this reference is not believed to deny the novelty of applicant’s claim 1.

- with regard to comparing said correlation value with correlation values for the corresponding (by their location in the image) pixels in other said high frequency channels and with a first threshold value for this channel, claimed in claim 1: this comparison enables to find the edge direction as it is described for example on pages 6, line 8, and 7, line 18, of the applicant’s specification. Matama does not appear to teach this operation, and column 16, lines 56-60, and column 17, lines 1-4, of Matama cited in the Office action (paragraph c2 of section 5 of the Office action) do not show this operation. The method disclosed by Matama does not allow finding the direction of edges but only allows distinguishing the portions of the image that contain some structures from those that are “flat” (Matama, column 16, lines 56-60). Failure to obtain the directional information causes image quality degradation.

- with regard to forming weighting coefficients based on the results of said comparing for each pixel of each of n-1 high frequency channels: what is disclosed in Matama as forming weighting coefficients (column 17, lines 44-46, cited in the Office action - paragraph c3 of section 5 thereof) is not based on the results of comparing for each pixel of each of n-1 high frequency channels. The method disclosed by Matama does not compare the correlation values obtained from different frequency channels (called medium and high frequency channels in Matama) as the data from these channels are combined together before computation of the correlation values (Matama, column 16, line 30 and further). The method according to the present invention, as claimed in claim 1, does compare the correlation values from different frequency channels. This principal difference enables to increase the noise suppression factors (page 5, lines 8, 10; page 7,

line 14, etc.). The differences in comparison of the correlation values in the applicant's invention and that disclosed by Matama determine the differences in the way to form the "weighting coefficients" and "gain." Particularly, the applicant's method forms the weight based on the comparison between *many* (n-1) correlation values (mutual comparison) *and* threshold value (page 7, lines 1-2; Fig. 8; claim 1), whereas the method according to Matama's invention compares correlation values to the threshold value only.

With the above in view, applicant does not believe that detecting edges as claimed in claim 1, is known from Matama.

V.4. Having regard to the above, applicant believes that Matama does not destroy the novelty of claim 1 of the applicant's invention and that claim 1 is thus patentable. Applicant respectfully submits that the 35 U.S.C. §102(b) rejection of claim 1 be withdrawn and claim 1 be allowed.

V.5. Claims 2-26 are believed to be patentable as directly or indirectly dependent from patentable claim 1.

V.6. The statement in the above section V.5. notwithstanding, and as far as claim 2 is concerned, it was discussed in the above (second paragraph of subsection V.3.) that Matama and the applicant's invention are different with regard to the concept of correlation values. It is believed therefore that comparing corresponding correlation value (in the spirit of claim 1) to the first threshold value upon forming weighting coefficients for each pixel of said each of said n-1 high frequency channels is not disclosed in Matama.

On that basis, it is believed that claim 2 is patentable.

V.7. With regard to claim 3, applicant's objection to the rejection of the claim is again that the concept of correlation value in Matama ("a correlation value ϵ among the red, green, and blue three colors" - see column 15, line 66 - column 16, line 1, of Matama) and in applicant's invention ("correlation between a processed pixel value and

values of its neighboring pixels” – see applicant’s specification, page 6, lines 14-15) are different, and therefore the knowingness of Matama’s correlation and the curves associated therewith is not believed to destroy the novelty of claim 3.

On that basis, it is believed that claim 3 is patentable.

V.8. With regard to claim 5, the Office action failed to show in Matama that m of $n-1$ high frequency channels are different from one another in a direction of their principal passing only. As a matter of fact, “principal passing” is not used in Matama at all, which is no accident because Matama teaches cross correlation between stochastic variables X and Y (column 16, lines 7-8 of Matama) depicted in Figure 10. It shows no plot in the spatial domain and for that reason is irrelevant to the “direction of principal passing.”

With this in view, it is believed that Matama does not destroy the novelty of claim 5, and it is believed patentable.

V.9. With regard to claim 6, column 16, lines 1-3, of Matama cited in the Office action says, verbatim: “... colors is calculated from the middle and high frequency components R_{MH} , G_{MH} , and B_{MH} of the fine scanning image signals S_F (R, G, B). The value of the gain M is determined...” Applicant believes that this citation (as well as any other) from Matama does not destroy the novelty of claim 6 claiming that “forming weighting coefficients for each pixel of each of m high frequency channels is made by comparing corresponding correlation value to the first threshold value and to the correlation values for corresponding (by their location in the image) pixels of other $m-1$ high frequency channels.”

On that basis, it is believed that claim 6 is patentable.

V.10. With regard to claim 7, column 17, line 60, of Matama cited in the Office action as related to claim 7 does not disclose anything even remotely resembling representing each pixel by a scalar value characterizing, for example, image intensity at the pixel that is claimed in claim 7.

With this in view, it is believed that Matama does not destroy the novelty of claim 7 and claim 7 is patentable.

V.11. With regard to claim 8, neither figure 9 nor column 17, lines 50, 60, nor column 19, lines 26-28, of Matama cited in the Office action to support the §102 rejection of claim 8 show, disclose or teach calculating the scalar value for each pixel by multiplication of the pixel value by a weighted sum of its neighboring pixels. As noted in the above, Matama does not deal with correlation between a pixel and its neighboring pixels, and therefore does not disclose operations conducted with them. Rather, the cited lines from Matama deal with calculating weighting coefficients, which is irrelevant to what is claimed in claim 8.

With this in view, it is believed that Matama does not destroy the novelty of claim 8 and claim 8 is patentable.

V.12. With regard to claims 10, 11, and 22, applicant submits that they deal (some wholly, some in part) with, and claim, the determination of a threshold value. Matama does not determine a threshold value, it deals with “a predetermined threshold value” only (Matama, column 14, line 59; column 17, lines 2, 6, 45, 47; column 19, lines 14, 17).

With this in view, it is believed that Matama does not destroy the novelty of claims 10, 11, and 22 and these claims are patentable.

V.13. With regard to claim 17, applicant’s objection to the rejection of the claim is again (see V.7. of the present response) that the concept of correlation value in Matama and in applicant’s invention are different and not interchangeable, and therefore the knowingness of Matama’s operations on frequency components and gain M associated therewith is not believed to destroy the novelty of claim 17.

On that basis, it is believed that claim 17 is patentable.

V.14. With regard to claim 19, the Office action cites Matama’s operations associated with “correlation values ... among the colors,” which is irrelevant to the

applicant's invention in general, and to claim 19 particularly. In cited lines, Matama is concerned with calculating correlation values (in the sense the patent discloses them) rather than with smoothing weighting coefficients that is claimed in claim 19.

With that in view, it is believed that Matama does not destroy the novelty of claim 19 and that claim 19 is patentable.

V.15. With regard to claim 20, 2,760X1840 picture elements referenced to in the Office action (Matama, column 9, line 55) are two-dimensional and for that reason have no relation to claim 20 claiming representing the original image in a p-dimensional matrix of the picture elements where $p \geq 3$.

With that in view, it is believed that Matama does not destroy the novelty of claim 20 and that claim 20 is patentable.

V.16. With regard to claim 21 claiming *the use of different threshold values for different parts of the image*, **those different threshold values being used to form the weighting coefficients at least in one of the n-1 high frequency channels**, applicant respectfully notes that the Office action cites lines 1-8 of column 17 of Matama against the first portion of the claim (put in italics), and those lines do not mention different threshold values whatsoever. As far as the second portion of the claim (put in bold in the above) is concerned, it is left without consideration.

With this in view, it is believed that claim 21 is patentable.

VI. Claim rejections under 35 USC § 103

VI.1. Claims 12, 13, 15, 16, and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Matama in view of Nishimura (US Patent No. 4,503,461 A).

Applicant respectfully disagrees.

With respect to claims 12, 13, 15, 16, and 23, applicant's objection to their §103 rejection is two-fold.

First, there must be some suggestion or motivation to combine the references. ("When a rejection depends on a combination of prior art references, there must be some

teaching, suggestion, or motivation to combine the references." In re Rouffet, 149 F.3d 1350, 1355, 47 USPQ2d 1453, 1456 (Fed. Cir. 1998) (citing In re Geiger, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987)). "Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). Although the suggestion to combine references may flow from the nature of the problem, see Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996), "[d]efining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness," Monarch Knitting Mach. Corp. v. Sulzer Morat GmbH, 139 F.3d 877, 880, 45 USPQ2d 1977, 1981 (Fed. Cir. 1998). Therefore, "[w]hen determining the patentability of a claimed invention which combines two known elements, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.'" In re Beattie, 974 F.2d 1309, 1311-12, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992) (quoting Lindemann, 730 F.2d at 1462, 221 USPQ at 488).)

There is no such a motivation found either in Matama or in Nishimura to combine those references.

Second, even if such a motivation had existed, the combination would have not represented a corresponding claim of the applicant's invention. The examiner rejects the novelty of Claims 12, 13, 15, 16 and 23 in the part of "picture element represented by a vector" based on the patent by Nishimura (page 11 of the Office Action). However, Nishimura does not mention anywhere in his patent that the pixel element can be represented by a vector. Nishimura does not specify the type of the picture element. Furthermore, he explicitly describes his invention as related to "a multiple measurement noise reducing system such as an X-ray imaging system" (Nishimura, Abstract and column 1, line 5). The "X-ray imaging system" produces images with scalar pixels. Therefore, the idea on interpreting multi-component images as a vector images is not disclosed by Nishimura.

The text cited in the Office action from Nishimura is related to a method of

detection of the artifacts in the scalar images by means of comparison of “the magnitude of the gradient vector at each point ... with thresholds...” (Nishimura, column 5, line 34). This method has nothing to do with representation of pixels and particularly representation of pixels by vectors.

With the above in view, it is believed that the §103 rejection of claims 12, 13, 15, 16, and 23 is overcome, and applicant respectfully submits that it be withdrawn.

VI.2. Claims 24 and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over Matama as applied to claim 1, and further in view of Feinberg et al. (U.S. Patent 5,270,654 A).

Applicant respectfully disagrees. Applicable here are the same counterarguments set forth above in section VI.1. of the present response: combining the references is not shown to be motivated, and, had it even been motivated, the combination of the references would have resulted neither in claim 24 nor in claim 25 of the applicant's invention. The reason for such a conclusion is that claim 1, which claims 24 and 25 directly and indirectly dependent from, differs from Matama, which, as shown in the above section V of the present response, is far from teaching “all the elements except for requiring a complex value.”

With that in view, applicant believes that the §103 rejection of claims 24 and 25 is overcome, and respectfully submits that it be withdrawn.

VI.3. Claims 9, 14, and 26 are rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Nishimura and Matama and Feinberg, and further in view of Meno (U.S. Patent 5,003,618).

Applicant respectfully disagrees. Applicable here are the same counterarguments set forth above in section VI.1. of the present response: combining the references is not shown to be motivated, and, had it even been motivated, the combination of the references would have resulted neither in claim 9 nor in claim 14 nor in claim 26 of the applicant's invention. The reason for such a conclusion is that claim 1, which claims 9, 14, and 26 indirectly dependent from, differs from Matama (even combined with

Nishimura and Feinberg), which, as shown in the above section V of the present response, is far from teaching “all the elements ... except for the remaining portion about the use of anisotropic weights ...” Although both Meno and applicant use anisotropic kernels, there are principal differences between their approaches: Meno uses the anisotropic filtering of unprocessed image data whereas the applicant applies anisotropic weights to the directionally filtered image data (page 14, line 23, and page 15, lines 7-16, of the applicant’s specification). Also, Meno uses the anisotropic filtering to produce the processed pixel values whereas the applicant uses anisotropic weights to calculate the correlation values. Meno selects the orientation of the anisotropic kernel according to the direction of the gradient (Meno, column 5, lines 23 - 29), this orientation being dependent on the local image data. On the contrary, the applicant selects the orientation of anisotropy to match “the direction of principal passing for the processed frequency channel” (Claims 9, 14 and 26). This direction does not depend on the local image data. This principal difference gives advantages in the image quality (absence of the selective noise emphasis) as described on page 9, lines 17-20.

With the above in view, applicant believes that the §103 rejection of claims 9, 14, and 26 is overcome, and respectfully submits that it be withdrawn.

VI.4. Claim 4 is rejected under 35 U.S.C. §103(a) as being unpatentable over Matama as applied to claim 1, and further in view of Matama.

Applicant respectfully disagrees. Claim 4 is considered obvious based on Matama’s Fig. 8A. However, Matama’s Fig. 8A depicts the dependence of “gain” on the hue property of the color image: “After the flesh-color region has thus been detected, the values of the gain M and the gain H with respect to the flesh-color region are changed. Specifically, as illustrated in FIG. 8A, a weight function for emphasizing the region of the hue angles, which correspond to the region hatched with the solid lines in FIG. 7, is determined.” (Matama, column 15, lines 4-9). To the contrary, applicant claims the dependence of the weighting coefficient on the correlation value that has nothing to do with Matama’s teaching about the hue dependencies and (in more generic terms) with color images. Therefore Matama’s Fig. 8 can not be used to show the obviousness of

claim 4.

With the above in view, applicant believes that the §103 rejection of claim 4 is overcome, and respectfully submits that it be withdrawn.

VI.5. Claim 18 is rejected under 35 U.S.C. §103(a) as being unpatentable over Matama as applied to claim 1, and further in view of Ito (U.S. Patent 5,907,642).

Applicant respectfully disagrees. The obviousness of claim 18 in its part that describes the non linear transformation of the correlation values is asserted based on Ito's "multi resolution transform" (Ito, column 15, line 41). However, what is claimed in claim 18 is a non linear transformation, whereas Ito's "multi resolution transform" is a linear transformation. Furthermore, the claimed "non linear transformation" applies to the scalar values of the correlation, whereas multi band transform applies to images and produces images (i.e. matrixes of data). The only common issue between Ito's patent and claim 18 is the use of terms "transform" or "transformation." It, however, is a generic mathematical term, and its use can not be used as a basis for asserting obviousness of a claim.

With the above in view, applicant believes that the §103 rejection of claim 18 is overcome, and respectfully submits that it be withdrawn.

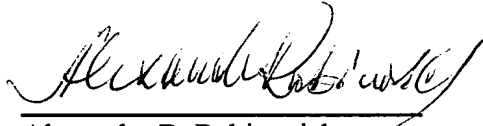
VII. Conclusion

All the above considered, claims 1-26 are believed to be in condition for allowance, and this favorable action is hereby respectfully solicited.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 18-0013, under Order No. 65843-0001 from which the undersigned is authorized to draw.

Serial No. 09/786,477
Atty Docket 65843-0001
Paper 4

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Alexander D. Rabinovich", written over a horizontal line.

Alexander D. Rabinovich
Registration No. 37,425
Rader, Fishman and Grauer PLLC
39533 Woodward Ave., Suite 140
Bloomfield Hills, Michigan 48304
(248) 594-0650,
Attorneys for Applicants

R0236978